Apprenticeship Training

Crane and Hoist Equipment Operator Boom Truck

34-305 (2005)

Alberta

Apprenticeship and Industry Training

ALBERTA ADVANCED EDUCATION CATALOGUING IN PUBLICATION DATA

Alberta. Alberta Advanced Education. Apprenticeship and Industry Training.
Crane and hoist equipment operator boom truck.

ISBN 0-7785-4281-5

1. Cranes, derricks, etc. - Maintenance and repair - Study and teaching - Alberta.
2. Hoisting machinery - Maintenance and repair - Study and teaching - Alberta.
3. Apprentices - Alberta. 4. Occupational and training - Alberta. I. Title. II. Series: Apprenticeship training.

HD4885.C2.C72.A333 2005 372.27

ALL RIGHTS RESERVED:
© 2005, Her Majesty the Queen in right of the Province of Alberta, as represented by the Minister of Alberta Advanced Education, 10th floor, Commerce Place, Edmonton, Alberta, Canada, T5J 4L5. All rights reserved. No part of this material may be reproduced in any form or by any means, without the prior written consent of the Minister of Advanced Education Province of Alberta, Canada.

2008-06062/

Table of Contents

Apprenticeship and Industry Training System 2
Apprenticeship and Industry Training Committee Structure 2
Local Apprenticeship Committees (LAC) 2
Provincial Apprenticeship Committees (PAC) 3
The Alberta Apprenticeship and Industry Training Board (Board) 3
Safety Education 3
Legal and Administrative Aspects of Safety 4
Technical Training Establishment 4
Procedures For Recommending Revisions To The Course Outline 5
Apprenticeship Route Toward Certification 6
Crane and Hoist Equipment Operator—Boom TruckTraining Profile 7
First Period Technical Training 8

Apprenticeship and Industry Training System

Apprenticeship is post-secondary education with a difference. It helps ensure Alberta has a steady supply of highly skilled employees, the foundation of our economy's future health and competitiveness.

Apprentices in more than 50 trades and crafts spend between one and four years learning their trade - 80% of the time on the job under the supervision of a certified journeyman or qualified tradesperson. The balance of the program is technical training in the theory, skills and technologies of their trade.

To become certified journeymen apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board (the Board) and a network of local and provincial industry committees.

The graduate of the Crane and Hoisting Equipment Operator (CHEO)—Boom Truck apprenticeship training is a journeyman who will be able to:

- responsibly do all work tasks expected of a journeyman.
- correctly use and care for tools and materials which are required to carry out the normal service and maintenance of the machines of the industry.
- operate and describe functions of the major and minor components of boom trucks.
- recognize and identify malfunctions and the proper procedures related thereto.
- recognize and evaluate conditions which are potentially hazardous to safe machine operation.
- interpret and apply load chart and related documentation.
- work in conjunction and communicate with other trades, employers and customers.
- interpret and apply visual and audio communication.

Apprenticeship and Industry Training Committee Structure

While government supports Alberta's apprenticeship and industry training system, it is driven by industry, a term which includes both employers and employees. The Alberta Apprenticeship and Industry Training Board, with the support of Alberta Advanced Education, oversees the system. But the system relies on a network of industry committees. These committees include local and provincial apprenticeship committees (LACs and PACs) in the designated trades and occupational committees (OCs) in the designated occupations, as well as other committees such as provisional committees established before the designation of a new trade or occupation comes into effect. All these committees are composed of equal numbers of employers and employees. The network of industry committees is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the Board can set up a LAC. The Board appoints equal numbers of employees and employers for terms of up to three years. The committee appoints a member as presiding officer. Local Apprenticeship Committees:

monitor the apprenticeship system, and the progress of apprentices in their trade, at the local level.

help settle certain kinds of issues between apprentices and their employers.

recommend improvements in apprenticeship training and certification to their trade's provincial apprenticeship committee.

make recommendations to the Board regarding the appointment of members to their trade's PAC.

Provincial Apprenticeship Committees (PAC)

The Board establishes a PAC for each trade and, based on PAC recommendations, appoints a presiding officer and equal numbers of employees and employers for terms of up to three years. Most PACs have nine members. Provincial Apprenticeship Committees:

identify the training needs and content for their trade.

recommend to the Board the standards for training and certification for their trade.

monitor the activities of local apprenticeship committees in their trade.

make recommendations to the Board about the designation of trades and occupations.

determine whether training of various kinds is equivalent to training provided in an apprenticeship program in the trade.

may participate in resolving any apprenticeship-related disputes between employers and employees.

Crane and Hoisting Equipment Operator PAC Members

Mr. J. Lane	Ft. McMurray	Presiding Officer
Mr. B. Tario	Calgary	Employer
Mr. A. McKernon	Red Deer	Employer
Mr. D. Cadotte	Lacombe	Employer
Mr. M. Packolyk	Slave Lake	Employer
Mr. D. Provencal	Ft. McMurray	Employer
Mr. L. Tucker	Edmonton	Employer
Mr. L. Schnepf	Red Deer	Employee
Mr. B. Kosmack	Calgary	Employee
Mr. M. McDonnell	Edmonton	Employee
Mr. E. Pinksen	Ft. McMurray	Employee
Mr. S. Murphy	Wainwright	Employee
Mr. B. Mahon	Edmonton	Employee

The Alberta Apprenticeship and Industry Training Board (Board)

The mandate of the Alberta Apprenticeship and Industry Training Board relates to the standards and requirements for training and certification in programs under the *Apprenticeship and Industry Training Act*. The Board provides advice to the Minister of Advanced Education on the training and certification of people in designated trades and occupations and on the needs of the Alberta labour market for skilled and trained persons. The Board also makes orders and regulations respecting standards and requirements for apprenticeship programs and the training of apprentices and for training and certification in designated trades and occupations, and the criteria or requirements for granting and recognizing trade and other certificates.

The 13-member Board consists of a chair, eight members representing trades and four members representing other industries. Employer and employee representatives equally represent the trades and other industry members.

Safety Education

Safe working procedures and conditions, accident prevention and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees and the public. Therefore, it is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to or cause an accident or injury.

It is generally recognized that a safe attitude contributes to an accident free environment. Everyone will benefit as a result of a healthy, safe attitude towards prevention of accidents.

A tradesperson is possibly exposed to more hazards than any other person in the work force and, therefore, should be familiar with and apply the Occupational Health and Safety Act and Regulations dealing with personal safety and the special safety rules applying to each task.

Legal and Administrative Aspects of Safety

Accident prevention and the provisions of safe working conditions are the responsibilities of an employer and employee.

Employer's Responsibilities

The employer is responsible for:

providing and maintaining safety equipment and protective devices.
ensuring proper safe work clothing is worn.
enforcing safe working procedures.
providing safeguards for machinery, equipment and tools.
observing all accident prevention regulations.
training employees in the safe use and operation of equipment.

Employee's Responsibilities

The employee is responsible for:

working in accordance with the safety regulations pertaining to the job environment.
working in such a way as not to endanger themselves or fellow employees.

Occupational Health and Safety's Responsibilities:

Occupational Health and Safety (Alberta Human Resources and Employment) will conduct periodic inspections of the workplace to ensure that safety regulations for industry are being observed.

Technical Training Establishment

Alberta Advanced Education, Apprenticeship and Industry Training offer your apprenticeship training program. Staff and facilities for delivering the program are supplied by:

Northern Alberta Institute of Technology (Souch campus)

Procedures for Recommending
Revisions To The Course Outline

Apprenticeship and Industry Training, Industry Programs and Standards has prepared this course outline in partnership with the Crane and Hoisting Equipment Operator Provincial Apprenticeship Committee.

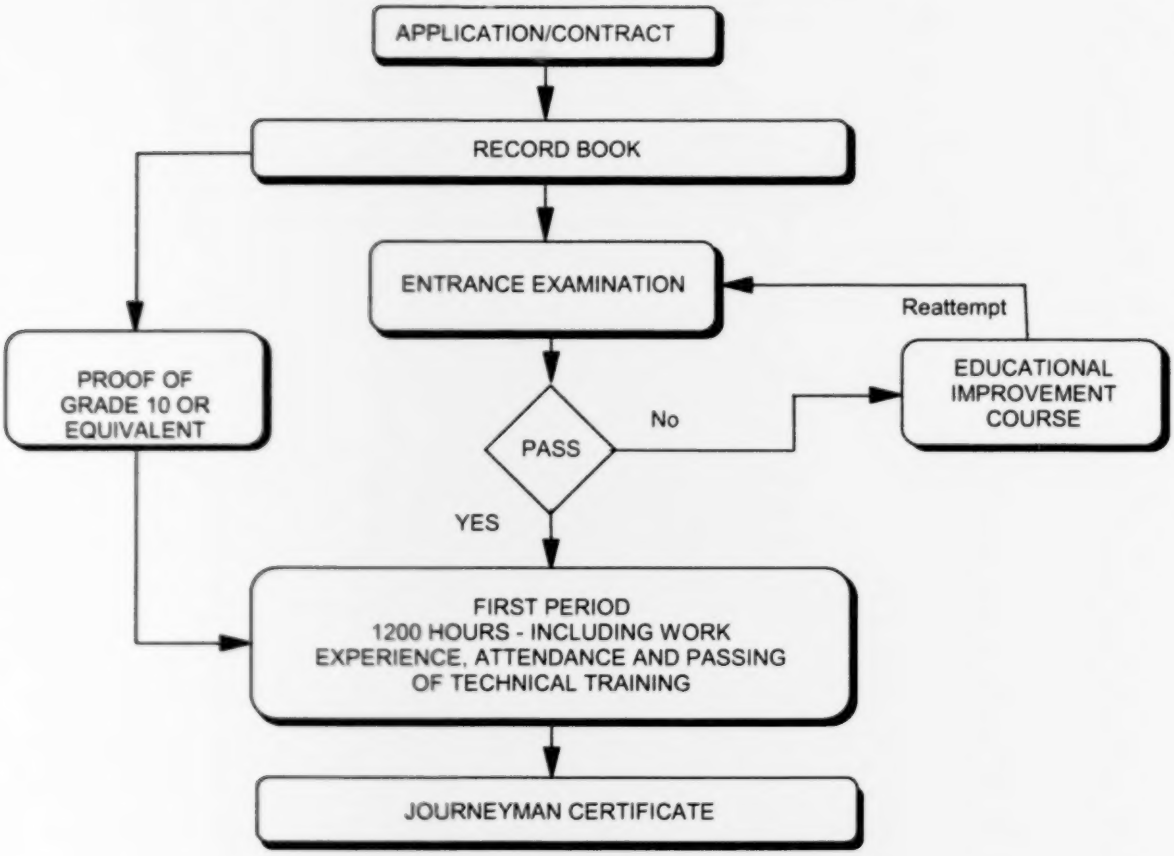
This course outline was approved on June 20, 2005 under the authority of the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. Valuable input is acknowledged from industry and the institutions.

Any concerned citizen or group in the Province of Alberta may make recommendations for change by writing to:

Crane and Hoisting Equipment Operator Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
10th floor, Commerce Place
10155 - 102 Street
Edmonton, AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations received will be placed before regular meetings of the Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Crane and Hoist Equipment Operator—Boom Truck Training Profile

FIRST PERIOD
(5 Weeks 30 Hours per Week – Total of 150 Hours)

SECTION ONE

BOOM TRUCK THEORY AND PRACTICAL — 61 Hours

A	B	C
Boom Truck Components and Functions — 10 Hours	Boom Truck Maintenance — 2 Hours	Boom Truck Hydraulic Systems — 4 Hours
D	**E**	**F**
Boom Truck Log Book — 1 Hour	Boom Truck Checks in Yard (Before Starting Engine) — 1.5 Hours	Boom Truck Checks in Yard (With Engine Running) — 1.5 Hours
F	**G**	
Transporting and Leaving Boom Truck Unattended — 5 Hours	Operating and Hoisting (Safety and Hazardous Situations) — 36 Hours	

SECTION TWO

PRINCIPLES OF CRANE OPERATION — 4 Hours

A
Principles of Crane Operation — 4 Hours

SECTION THREE

LOAD CHARTS — 30 Hours

A
Load Charts — 30 Hours

SECTION FOUR

OPERATING PROCEDURES — 33 Hours

A	B	C
Pre-Lift Planning — 12 Hours	Operating Procedures — 15 Hours	Crane Set Up (Practical) — 6 Hours

SECTION FIVE

SAFE RIGGING AND RIGGING PROCEDURES — 18 Hours

A	B
Safe Rigging of the Load — 12 Hours	Advanced Rigging — 6 Hours

SECTION SIX

INTRODUCTION TO NEW TECHNOLOGY — 2 Hours

A
New Technology — 2 Hours

SECTION SEVEN

MULTI-CRANE LIFTS — 2 Hours

A
Multi-crane Lifts — 2 Hours

NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations.

FIRST PERIOD TECHNICAL TRAINING
CRANE AND HOIST EQUIPMENT OPERATOR—BOOM TRUCK TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: .....BOOM TRUCK THEORY AND PRACTICAL.....61 HOURS

A. Boom Truck Components and Functions ..... 10 Hours

Outcome: ***Explain and demonstrate knowledge of boom trucks and components.***

1. Identify the structural and operational characteristics of boom trucks.
   a) telescoping (stiff) boom
   b) articulating boom

2. Identify and describe the components of boom trucks and their functions (for stiff boom and articulating boom)
   a) truck chassis
   b) rear/front stabilizers
   c) turret or pedestal (including mounting bolts)
   d) swing circle
   e) base or heel section
   f) telescopic powered and manual boom sections
   g) boom extensions (jibs)
   h) main hoist
      i) main hoist line
      ii) main hoist block
      iii) winch
      iv) anti-two block (A2B) device
   i) auxiliary hoist
      i) auxiliary hoist line (jib or whip)
      ii) auxiliary hoist ball and hook (headache or overhaul)
      iii) anti-two block (A2B) device
   j) boom
      i) boom section
      ii) telescoping sections
      iii) pinned sections
      iv) boom extension cylinders
      v) boom lift cylinders
      vi) boom wear pads
      vii) rest (cradle)
   k) jib
      i) lattice type
      ii) a-frame type
      iii) box section type
   l) outriggers
      i) outrigger beams
      ii) outrigger jacks
      iii) outrigger cylinders
      iv) outrigger pads (floats or pontoons)
      v) front bumper outrigger
   m) swing assembly
      i) pedestal
      ii) turret
      iii) rotation bearing (slewing ring, swing circle, ball race)
   n) carrier
      i) frame

ii) sub frame
iii) mounting bolts
iv) bed (optional)
v) counterweight(s) (front bumper)

o) control system
p) load moment devices
q) lockouts

B. Boom Truck Maintenance..... 2 Hours

Outcome: ***Explain and demonstrate maintenance of boom truck.***

1. Maintain equipment (including some adjustments) as specified by the manufacturer, which includes:
   a) tires
      i) maintain correct inflation
      ii) repair/report any damage before permanent damage occurs
      iii) report when tires need replacing
      iv) tighten wheel lugs if loose
   b) Identify lubrication points on boom truck
   c) Conduct basic 'housekeeping' duties
   d) Check for leaks and fluid levels
   e) Check swing gear box.
   f) Check mounting bolts.
2. Describe the functions, characteristics, types, and classification of lubricants.
3. Interpret manufacturer's manual to determine:
   a) types of lubricants
   b) method of lubrication
   c) lubrication schedule
4. Identify the lubrication points for each component.
5. Identify and demonstrate use of:
   a) hand-operated guns and oilers
   b) pneumatic and pressurized equipment
   c) mobile lubricators and dispensers

C. Boom Truck Hydraulic Systems ..... 4 Hours

Outcome: ***Explain and demonstrate knowledge of basic hydraulic system components and operation.***

1. Describe the basic principles of operation of an hydraulic system
   a) pumps and motors
   b) cylinders
   c) circuits
2. Describe the transmission of engine power through hydraulic power to such functions as:
   a) swinging/slewing
   b) boom up/down
   c) hydraulic boom extension and retraction
   d) hydraulic pumps and motors
3. Identify the following components of a basic hydraulic system:
   a) reservoirs
   b) pumps
   c) control valves
   d) relief valves (port and main)
   e) connecting hoses
   f) cylinders - check and holding valves
   g) motors
   h) gauges

i) filters/strainers - suction, pressure and circuit coolers
j) hydraulic oil coolers

4. Determine the effects of cold weather and contaminants in the system.

D. Boom Truck Log Book ..... 1 Hour

Outcome: ***Explain and demonstrate the use of the equipment log book.***

1. Describe the steps required to maintain an equipment log book as per owner's instructions and in accordance with the Occupational Health and Safety Act.
2. Record usage and work location of equipment as required by the owner.

E. Boom Truck Checks in the Yard (Before starting the engine) ..... 1.5 Hours

Outcome: ***Explain and demonstrate knowledge and skill in conducting an equipment check in the yard prior to starting the engine.***

1. Describe the process for conducting checks in the yard (before starting the engine).
2. Use and interpret manufacturer's manual to determine:
   a) inspection procedures
   b) inspection schedule
   c) items to inspect
      i) all fluids at sufficient levels, including fuel, crankcase oil, coolant, hydraulic
      ii) battery electrolyte level correct
      iii) belts, radiator hoses - in place and not damaged or frayed
      iv) visual check for loose bolts/mountings around engines
      v) coolant or oil leaks
      vi) air cleaner and connections secure
      vii) drain cocks closed
   d) location of items to inspect
   e) location and function of control panel gauges
   f) evidence of vandalism
   g) safety guards - in place
3. Conduct pre-operational checks using tools such as:
   a) wheel wrench
   b) tire gauge
4. Explain the importance of checks prior to starting the engine.

F. Boom Truck Checks in the Yard (with the Engine Running) ..... 1.5 Hours

Outcome: ***Explain and demonstrate knowledge and skill in conducting an equipment check in the yard after starting the engine.***

1. Describe the process for conducting checks in the yard (with engine running)
2. Demonstrate the pre-operational checks to be made while the boom truck is running, engine brought up to operating temperature, and with boom truck on firm base:
   a) engine operation
      i) oil pressure—normal gauge reading
      ii) temperature—normal gauge reading
      iii) battery—not discharging, ammeter/voltmeter reading normal
      iv) air cleaner indicators—normal reading
   b) air systems
      i) pressure correct for operation
      ii) hoses—check for cuts, abrasions and bulging, ensure tight and leak-proof
      iii) tanks, dryers

c) hydraulic system
   i) check for oil leaks
   ii) filters: check gauge/warning light/alarm
   iii) hoses – check for cuts, abrasions and bulging, ensure tight and leak-proof
   iv) reservoirs
d) all boom truck controls operational (e.g. hoist, swing, boom telescoping, lower/raise load line, swing brake, travel lock (if equipped))
   i) test anti-two-blocking devices by raising hook until contact is made
   ii) back up alarm, warning flashers, bells or horns
   iii) ensure hydraulic boom will telescope with sections extending equally or sequentially as per manufacturer's instructions
e) load weighing or moment devices are operational
f) safety and warning devices are operational
g) wire rope—check for wear and replace where necessary (replacement criteria is defined by manufacturer's specifications and ANSI codes)
h) tires—check for cuts, abrasion and wear, adequate pressure
i) braking system
   i) service brake check
   ii) emergency and/or parking brakes are operational
j) steering operational, correct alignment, and without excessive slackness
k) lighting is operational, includes
   i) dash/control panels
   ii) floodlights
   iii) headlights
   iv) dome lights
   v) running/clearance
   vi) back-up lights
l) fastening devices on boom—pins and keepers in place
m) hooks and hook blocks
   i) hook—check for cracks and deformation, hook should rotate freely
   ii) sheaves—check for excessive wear and rotating freely

G. Transporting and Leaving Boom Truck Unattended ..... 5 Hours

Outcome: ***Explain and demonstrate knowledge and skill in transporting a boom truck and/or leaving a boom truck unattended.***

1. Prepare boom trucks for transportation by following manufacturer's instructions, which include:
   a) remove parts and attachments to comply with highway regulations (counterweights if necessary)
   b) if machine is rigged, tie hook block down and tightening hook block down sufficiently to prevent excessive movement during travel
   c) secure the load with proper tie-downs
   d) set all brakes, latches and house locks
   e) disengage pump (PTO)
   f) lock doors and panels

2. Demonstrate procedures for leaving the boom truck unattended when it is set up to do a job by following manufacturer's instructions, codes and statutes, which include:
   a) landing any attached loads
   b) setting all brakes and locking devices
   c) securing the unit against accidental travel and unexpected movement by the use of blocking and parking brake
   d) disengage pump
   e) park on a level and stable area
   f) retract hydraulic booms and lower into cradle
   g) shut off power source(s)/master switch
   h) lock and secure vehicle, equipment, bins and storage containers

H. Operating and Hoisting (Safety and Hazardous Situations) ..... 36 Hours

Outcome: ***Explain and demonstrate knowledge and skill in operating a boom truck safely in hazardous situations.***

1. Identify the responsibility of each person regarding operating procedures for a lift:
   a) crane operator
   b) rigger
   c) signal person
   d) site supervisor
   e) maintenance person(s)
   f) crane owner

2. Describe applicable statutes and codes affecting boom truck operation:
   a) Occupational Health and Safety Act (construction and general)
   b) CAN/CSA Z150-98
   c) Crane and Hoisting Equipment Operator Trade Regulation
   d) Bill C45

3. Perform trade calculations
   a) mentally, on paper, or with a calculator:
      i) add
      ii) subtract
      iii) multiply
      iv) divide
      v) order of operations
      vi) fractions
      vii) convert fractions to decimals
      viii) percentages
      ix) convert feet and inches into feet
      x) determine the area and volume of geometric shapes (including rectangles, triangles, cubes (metric and imperial)
      xi) circumference and area of circles
      xii) imperial and metric conversion
   b) use accepted industry formulas for the items listed:
      i) load weights
      ii) load distribution
      iii) effect of sling angle
      iv) sheave friction
      v) number of parts of line required
   c) calculate safe working loads for slings.

4. Identify and describe how cranes can be overloaded by:
   a) lifting loads in excess of their gross capacity
   b) booming down and increasing load radius
   c) telescoping out and increasing load radius
   d) shock loading

5. Describe and demonstrate the correct way to raise or lower the load, boom and swing the load including points such as:
   a) raising
   b) lowering
   c) swinging
   d) releasing the load
   e) raising and lowering booms
   f) telescoping hydraulic booms
   g) no impact
   h) no overloading
   i) no excessive side loading
   j) no free fall
   k) no swing-out
   l) allowance made for wind

m) allowance for boom deflection (loading/unloading)

6. Define and describe static load vs. dynamic load.

7. Describe the process for releasing the load without impact.

8. Describe how to protect personnel in the vicinity of the lift by:
   a) avoiding swinging over people/property if possible
   b) using barricades
   c) using job rules and Alberta Occupational Health and Safety Act
   d) ensuring that when welding is being done:
      i) the boom truck is properly grounded
      ii) welding cables are not dragged across the machine

9. Describe the operation of the crane around high voltage equipment
   a) Interpret provincial statutes and codes to determine procedures to use when working around high voltage equipment.
   b) Describe how to operate around high voltage equipment considering:
      i) limits of approach—defined by statutes
      ii) location of personnel
      -only required personnel to be in area of lift
      -no one is to be simultaneously touching boom truck or load and ground
   c) notification of local utility company when and where boom truck is to be working
   d) use of designated signal person(s)

10. Describe procedures to follow if electrical contact is made:
    a) operator remains at controls
    b) warn people away
    c) remove contact if possible
    d) escape procedures if necessary
    e) inspect boom truck for damage (recertification)

11. Describe and demonstrate communication during the lift.
    a) communication with job supervisors about general job procedures
    b) audio signals to lift, move, lower, and position various loads when loads are out of view of operator
    c) types and characteristics of audio communicators
    d) proper operation of audio communicators

12. Recognize crane and hoist operation terminology and movements.

13. Use hand signals to lift, move, lower, and position loads when loads are out of view of the operator.

14. Use and interpret international hand signals and determine their application for boom truck and hoist operations.

15. Use and interpret horn signals.

16. Describe how a signal-person must be identified.

17. Assess factors that influence the capacity of a boom truck (articulating and telescoping)

18. Describe set-up conditions affecting boom truck capacity, such as:
    a) off-centre reeving
    b) equipment condition
    c) off-level boom truck
    d) outrigger extension
    e) effect of firm base
    f) definition of a firm base
    g) hook placement

19. Describe operating conditions affecting boom truck capacity, such as:
    a) side loading
    b) impact loading
    c) swing-out
    d) swing rate
    e) weather
       i) wind
       ii) cold

iii) moisture
iv) ice and snow
f) machine configuration
g) base configuration
h) load radius
i) vertical hoist line
j) dynamic loading caused by rapid hoisting or lowering

SECTION TWO: ..... PRINCIPLES OF CRANE OPERATION ..... 4 HOURS

A. Principles of Leverage ..... 3 Hours

Outcome: ***Explain and demonstrate knowledge of principles of leverage.***

1. Describe the principles of leverage and the relationship between leverage and stability.
2. Define the following terms:
   a) leverage of a crane
   b) leverage of a load
   c) tipping axis
   d) centre of rotation
   e) centre of gravity
3. Identify the symbol for centre of gravity.
4. Identify and determine the centre of gravity for major boom trucks:
   a) centre of gravity of a crane
   b) centre of gravity of a load
   c) centre of gravity location during rotation of upper works
5. Define fulcrum and how it applies to crane operation.
6. Describe the basic mechanical advantage of leverage systems and the leverage systems used in craning:
   a) class 1 lever
   b) class 2 lever
   c) class 3 lever
7. Describe the load leverage principles including:
   a) leverage and stability
   b) stability vs. instability
   c) effect of tipping axis location on stability and capacity
8. Describe changes in crane leverage during rotation of upper works:
   a) most stable area
   b) less stable area
   c) least stable area
9. Describe changes in crane capacity during rotation of upper works for:
   a) greatest capacity
   b) less capacity
   c) least capacity
10. Describe the load moment for:
    a) tipping moment
    b) resisting moment
11. Describe the tipping axis location as the upper structure rotates.
12. Describe forward stability rating in percentage of tipping.
13. Describe backward stability for a boom truck.
14. Describe static load vs. dynamic load.

15. Describe the effect of the load on the boom:
    a) Telescopic (stiff) booms
        i) load on boom hoist
        ii) cylinders (high angle)
        iii) load taken on the boom in bending/deflection.
        iv) compression
    b) Articulating booms
        i) load on boom hoist
        ii) cylinders (high angle)
        iii) load taken on the boom in bending/deflection
        iv) compression

B. Areas of Operation ..... 1 Hour

Outcome: ***Explain and demonstrate knowledge of areas of operation.***

1. Describe the importance of areas for operation for boom trucks.
2. Identify the sweep area.
3. Describe the division of sweep area into quadrants.
4. Describe and identify working areas.

SECTION THREE: ..... LOADS CHARTS ..... 30 HOURS

A. Basic Terms and Conditions ..... 6 Hours

Outcome: ***Explain and demonstrate knowledge of the basic terms and conditions of load charts.***

1. Describe how the factors listed below affect load chart conditions:
    a) boom length
    b) operating radius
    c) boom angle
    d) boom truck configuration
    e) load weight
2. Explain the difference between gross capacity and net capacity.
3. Explain the difference between gross load and net load.
4. Describe the difference between
    a) tipping capacity
    b) structural capacity
5. Determine if capacity is limited by structural strength or stability:
    a) shaded areas used for structural rating
    b) bold line divides the two areas
    c) asterisks or stars used for structural rating
6. Use quadrant of operation chart to determine appropriate load chart such as:
    a) 360° chart on outriggers
    b) over the side and rear chart (some boom trucks)
    c) over the front
        i) no swinging or limited swing (see chart notes)
        ii) front outrigger set (some boom trucks)
        iii) over the rear chart

B. Configuration of Crane Upper Structure ..... 24 Hours

Outcome: ***Explain and demonstrate knowledge and skill in planning and configuring the upper structure of the crane.***

1. Identify boom lengths required including:
   a) boom length definition
   b) boom length between chart listing
2. Identify boom angle required including:
   a) boom angle definition
   b) boom angle between chart listing
3. Identify load radius required including:
   a) load radius definition
   b) load radius between chart listings
4. Determine the parts of line required when considering the following:
   a) sheave friction
   b) line pull
   c) safe working load of wire rope
5. Use range diagrams to determine the following:
   a) boom point elevations
   b) boom clearance
   c) boom tip headroom
   d) boom angle
6. Identify the areas of operation.
7. Calculate main boom capacities for full power telescopic (stiff) booms:
   a) select gross capacity from (main boom) load chart
   b) determine number of parts of line and hook required
   c) deduct all hook blocks, headache balls and rigging
   d) deduct auxiliary boom sheave and stowed jib and/or boom extension (if applicable)
   e) deduct weight of parts of line exceeding those allowed by the manufacturer
8. Calculate main boom capacities (jibs and boom extensions installed) for full power telescopic (stiff) booms
   a) select "gross capacity" from (main boom) load chart
   b) determine number of parts of line and hook required
   c) deduct all hook blocks, headache balls and rigging
   d) deduct effective weight of jib and/or extensions mounted
   e) deduct auxiliary boom sheave and stowed jib and/or boom extension (if applicable)
   f) deduct weight of parts of line exceeding those allowed by the manufacturer
9. Calculate boom extension capacities for full power telescopic (stiff) booms
   a) select "gross capacity" from (boom extension) load chart
   b) determine number of parts of line and hook required
   c) deduct all hook blocks, headache balls and rigging
   d) deduct effective weight of jib if mounted
   e) deduct auxiliary boom sheave and stowed jib (if applicable)
10. Calculate jib capacities for:
    a) jib types and length
    b) jib offset
    c) jib capacity for full power telescopic booms
    d) jib capacity for pinned telescopic booms
       i) jib capacities using charts
       ii) structural capacity from jib chart
       iii) tipping capacity from boom chart
11. Calculate lifting capacities for articulating booms.
12. Identify and describe factors which influence capacity:
    a) geometry and configuration of crane

i) manufacturer's specifications
ii) boom and jib configuration
iii) counterweights

b) areas of operation
c) outrigger beams extension
i) 100% extended
ii) 50% extended option (see load chart)
iii) 0% extended option (see load chart)
d) boom length
e) boom angle
f) load radius
g) deductions from gross capacity

13. Identify and describe factors which affect capacity:
a) machine condition
b) eccentric reeving
c) improper use of outriggers
d) ground condition
e) off-level crane
f) side loading
g) increase of load radius
h) rapid swing rate
i) impact loading (shock loading)
j) conditions affected by duty cycle
i) clamming
ii) steel erection
iii) others specialized operations
k) weather (wind, ice, moisture, frost)
l) operator experience

SECTION FOUR: ..... OPERATING PROCEDURES ..... 33 HOURS

A. Pre-Lift Planning and Tasks ..... 12 Hours

Outcome: ***Explain and demonstrate knowledge and skill in planning a lift.***

1. Explain and interpret lift study drawings.

2. Inspect access to the boom truck site to ensure area is compacted, graded and free from hazards:
a) access roads adequate
b) operating locations firm and level
c) operating locations away from trenches and/or underground hazards
d) blocking and/or hardwood mats available
e) operating locations away from power lines
f) sufficient room for crane erection
g) access to site restricted to authorized personnel
h) competent personnel only (rigging crew)

3. Determine the crane configuration and attachments required for the lift taking into consideration pre-calculated gross load in accordance with manufacturers' manuals, OH & S policy.

4. Determine proper crane set up location.

5. Locate the crane on firm level ground with outriggers extended and stabilizers set:
   a) correct outrigger use (set up)
      i) as per manufacturer's recommendation
      ii) pads on firm footing
      iii) pads to be at right angle and secured
      iv) beams extended to manufacturer's specifications

6. Demonstrate calculations of maximum outrigger loadings:
   a) use outrigger pad blocking to reduce ground pressure

7. Describe procedures necessary when temperatures fall within cold weather operations parameters:
   a) avoid maximum capacity lifts
   b) slow down cycle of operation
   c) no dynamic or shock loading of any structural components
   d) proper warm up of hydraulic system
   e) slow, smooth and infrequent lifting and only if necessary
   f) lifting as per manufacturer's charts

B. Operating Procedures..... 15 Hours

Outcome: ***Explain and demonstrate operation of a boom truck.***

1. Identify weights of loads using available means:
   a) information shown on load
   b) source of weight information, e.g. drawings, shipping bills, catalogues, etc.
   c) use of load weighing devices
   d) estimating weight using accepted industry formulas (volume, density and area)

2. Demonstrate the use of a lift study to perform a set-up.

3. Determine the centre of gravity of the load:
   a) stable vs. unstable
   b) relative to rigging position and sling force
   c) centre of gravity of load under crane hook

4. Define and determine a critical lift:
   a) precautions to be taken
   b) lift study

5. Demonstrate use of boom angle indicators:
   a) exact radius over boom angle

6. Identify reasons for slack rope on drums and uneven spooling including:
   a) rope incorrectly installed on the drum
   b) incorrect fleet angle
   c) sheaves poorly lubricated
   d) sheaves stiff due to cold weather
   e) effect of wind on the hoist line (side wind)
   f) sudden stop as load is being hoisted
   g) hook block or headache ball too light
   h) sudden change in rope tension
   i) excessive speed when lowering hook block or headache ball

7. Demonstrate procedures to protect personnel during the lift:
   a) between upper works and carrier
   b) swing area of crane during operation
   c) outrigger jacks during lowering
   d) extending and retracting outrigger beams

8. Demonstrate safety procedures when working near power lines:
   a) operator responsibility
   b) site supervisor responsibility
   c) pre-job planning
   d) rules and regulations (OH & S)
   e) maintaining a safe distance
   f) in the event of contact
   g) bailout procedure
   h) working near transformers

9. Describe the effect on the boom when the following happens:
   a) load contacting boom
   b) boom touching or resting on structure
   c) boom design (compression vs. bending)

10. Describe how two-blocking happens and the results:
    a) telescoping or lowering boom
    b) hook block or headache ball pull into boom tip sheaves

11. Describe how to telescope the booms following manufacturer's instructions:
    a) powered section extended equally
    b) newer cranes designed for sequencing of boom sections
    c) use of manually telescoping sections

12. Interpret and use international signals designed for hoisting operations:
    a) use and interpret hand signals
    b) use audio or radio signals

13. Identify and describe procedures and precautions when working with jibs:
    a) jib offset to main boom
    b) safe operating procedures with long booms and jibs
    c) jib capacity (strength or tipping rating)

14. Describe the effects and causes of overloading:
    a) tipping failure
    b) structural failure
    c) mechanical failure

15. Demonstrate the correct outrigger use (set up):
    a) tires off the ground as per manufacturer
    b) pads on firm footing
    c) pads to be at right angle and secured
    d) beams extended to manufacturer's specifications

16. Identify safe ground stability for the operation of a boom truck:
    a) crane and ground pressure calculations
    b) outrigger pads blocking to reduce ground pressure

17. Demonstrate proper procedures to level the crane with ground by raising or lowering the outrigger jacks, blocking, and ensuring crane is level using a levelling device:
    a) in the cab level
    b) on the carrier deck level
    c) on the base of turntable (carpenter's level)
    d) using hoist line

C. Boom truck Set Up (practical)..... 6 Hours

Outcome: ***Demonstrate the ability to set up a boom truck.***

1. Demonstrate proper set up for boom trucks:
   a) minimum swing clearance
   b) outrigger beams fully extended (most boom trucks)
   c) pads set on firm footing

d) boom truck level
e) know weight of load
f) know radius of lift
g) centre of gravity of load in line with hoist line
h) site inspection for hazards

2. Describe safety procedures involved in rigging up or rigging down boom trucks.
3. Demonstrate procedures of rigging up or rigging down for boom trucks.
4. Demonstrate how to measure the load radius.
5. Determine the total load from the net load.
6. Apply the total load to the values in the load capacity chart, area diagram and range diagram, to determine where the load can be placed prior to and after hoisting.
7. Determine maximum radii at which given weights may be safely handled.
8. Operate the equipment in a safe, smooth and controlled manner.
9. Describe the following workplace coaching skills used for training apprentices:
   a) identify the point of the lesson
   b) link the lesson
   c) demonstrate a skill
   d) provide opportunity to practice a skill
   e) give feedback to the learner
   f) assess the learner's progress

SECTION FIVE: ..... SAFE RIGGING PRACTICES AND RIGGING PROCEDURES..... .....18 HOURS

A. Safe Rigging Practices ..... 12 Hours

Outcome: ***Explain and demonstrate knowledge and skill in safely rigging a load.***

1. Identify types of rigging hardware.
   a) shackles
   b) wire ropes
   c) slings
   d) turnbuckles
   e) come-along
   f) choker hooks
   g) spreader bars
   h) equalizer beams
   i) chain hoists
   j) sheaves
   k) hooks
   l) rings, links and swivels
   m) eye bolts and lugs
   n) wire rope blocks
   o) snatch block

2. Describe and demonstrate the uses of spreader bars, including:
   a) purpose
   b) effect on horizontal forces on the load
3. Explain and demonstrate the use of taglines to control the load.
4. Describe how loading is equalized by using such devices as:
   a) turnbuckles
   b) come-along or chain hoist
   c) safety slings (used with come-along and chain hoist)
5. Describe and demonstrate procedures for rigging boom trucks from:
   a) wire rope on drums of boom truck
   b) wire rope on reels
6. Describe and demonstrate methods of reeving and lacing.
7. Identify and describe types and configurations for slings including:
   a) wire rope slings
   b) nylon web slings
   c) polyester and Kevlar
   d) metal mesh slings
   e) chain slings
8. State the design factor for slings.
9. Recognise and demonstrate the use of various sling arrangements.
   a) single vertical hitch
   b) bridle hitch
   c) single basket hitch
   d) double basket hitch
   e) double wrap basket hitch
   f) single choker hitch
   g) bridle choker hitch
   h) double wrap choker hitch
10. Describe materials and constructions used in slings, such as:
    a) synthetic
       i) Nylon web
       ii) Round sling
       iii) Twin path
    b) steel (wire rope)
       i) grommet
       ii) eye to eye
       iii) eye to hook
11. Identify the types of slings used, such as:
    a) synthetic and wire rope
       i) grommet (endless)
       ii) eye to eye
       iii) eye to hook
    b) chain
       i) master link to master link
       ii) master link to hook
       iii) multiple chains on master link to master links or hooks (alloy steel)
12. Explain the advantages and disadvantages of slings made from:
    a) synthetic materials
    b) wire rope
    c) chain
13. Determine sling angle and calculate strength.
14. Ensure that softeners or protection is used to protect slings.

15. Maintain wire rope and slings
    a) replace if necessary
    b) lubricate when necessary
16. Identify "Rule of Thumb" formulas.
17. Describe the types of cable clips available.
18. Select and apply cable clips ensuring:
    a) clip is steel drop forged
    b) placement of single saddle clips with saddle on live end of ropes being joined
19. Recognize that the strength of cable clips is less than the strength of the rope being used.
20. Determine the number and spacing of clips.
21. Interpret wire rope manufacturer's ratings to determine the safe working load of wire rope (hoist lines and slings):
    a) size
    b) parts of line
22. Calculate the safe working load (SWL) by dividing the catalogue breaking strength by the factor of safety.
23. Describe the effects of load centre of gravity and sling location on load stability.
24. Identify and describe both safe and unsafe rigging practices.
25. Identify and describe sheave standards and inspection criteria.
26. Identify and describe drum standards and inspection criteria.
27. Identify and describe rigging hitches.
28. Describe procedures to determine defective rigging components and for taking out of service.
29. Identify and describe the composition of wire rope:
    a) wire
    b) strand
    c) core (fibre or wire or strand)
30. Interpret and describe rope lay:
    a) regular lay
    b) lang lay
    c) right lay and left lay
    d) alternate lay
    e) herringbone or twin strand lay
    f) specialty ropes
31. Describe how the various wire ropes used in hoisting differ in such characteristics as:
    a) construction
    b) grades of steel
    c) rope lay
    d) core
32. Identify specialty ropes and how/where they are used (including limitations).
33. Describe and interpret sizes, grades and construction of all types of rigging and hoisting ropes.
34. Identify and compare preformed vs. non-preformed ropes.
35. Identify and describe the fatigue and abrasion resistances of wire ropes (fatigue and abrasion resistance, breaking strength).
36. Identify safety factors for:
    a) rigging slings
    b) running ropes
    c) standing ropes
37. Calculate safe working loads.
38. Identify the strand classification group:

39. Identify and describe uses for non-rotating and rotation resistant ropes.
40. Demonstrate proper installation and procedures for all types of wire rope.
41. Inspect, use, handle and maintain wire rope:
    a) lubrication
    b) cleaning
42. Identify and install end fittings and connections.
43. Maintain the minimum rope wraps on a drum as per regulations.
44. Identify grades of chain including:
    a) strength
    b) inspection
    c) care and use
45. Describe and define reeving.
46. Determine the parts of line required.
47. Describe the effect of winch diameter for:
    a) multi-layer (wire rope)
    b) line speed vs. torque
48. Determine sheave loads.
49. Determine the SWL of rope vs. line pull.
50. Describe the effect of sheave friction during a lift.
51. Identify the mechanical advantage of reeving.
52. Demonstrate wire block reeving methods:
    a) lacing
    b) square or angle reeving
    c) skip reeving

B. Advanced Rigging..... 6 Hours

Outcome: ***Explain and demonstrate knowledge and skill in advanced rigging procedures.***

1. Demonstrate and plan rigging operations.
2. Demonstrate proper rigging procedures and calculations.
3. Calculate loads on equalizer beams
4. Determine tensions on sling legs.
5. Use the proper methods for determining load weights.
6. Determine the centre of gravity for various loads.
7. Identify and describe rigging hitches.
8. Identify and describe both safe and unsafe rigging practices.
9. Identify and describe sheave standards and inspection criteria.
10. Identify and describe drum standards and inspection criteria.
11. Describe procedures to determine defective rigging components and for taking out of service.
12. Describe the reasons for using competent personnel to apply rigging.
13. Describe rigging procedures when lifting a personnel basket.

SECTION SIX: .....INTRODUCTION TO NEW TECHNOLOGY.....2 HOURS

A. New Technology..... 2 Hours

Outcome: ***Explain and demonstrate knowledge of new boom truck technology.***

1. Describe new technology
   a) LMI/A2B System
   b) intrinsically safe wireless systems
2. Provide general description of new boom trucks.
3. Optional fieldtrip to review and study new technology.

SECTION SEVEN: ..... MULTI-CRANE LIFTS .....2 HOURS

A. Multi-Crane Lifts..... 2 Hours

Outcome: ***Explain and demonstrate knowledge of multi-crane lifts.***

1. Describe factors affecting multi-crane lifts:
   a) lift to be planned and carried out by qualified supervision
   b) weight transfer of load
   c) requirement for lift study
   d) exact determination of maximum load on each crane
   e) one person to control and direct operation during lift
2. Describe why it is recommended that loading on each crane should not exceed 75% of capacity as measured on the lifting chart or an engineer's recommendation.

Excellence through training and experience

34-305